

## SPECIFICATION

### LED LAMP FOR LIGHT SOURCE OF A HEADLAMP

#### 5 BACKGROUND OF THE INVENTION

##### 1. Field of the Invention

The present invention relates to LED lamps, and in particular, to the configuration of LED lamps used as light sources in vehicle lights. Furthermore, it relates to the configuration of an LED lamp suitable for use as a light source in  
10 a vehicle lamp for illumination purposes that has not previously been put to use as headlamps (or headlights), auxiliary headlamps (or fog lights), or the like.

##### 2. Detailed Description of the Prior Art

When LED lamps are used as a light source in flashlights and other similar lamps for the purpose of illumination in the prior art, a large LED chip is  
15 housed in a large package and light <sup>amount</sup> is obtained by, for example, applying a current of between several ten and several hundred milliamperes. Simultaneously, as the package is made large in size, deterioration or breakage of the LED chip as a result of overheating is prevented by effectively conducting the heat emitted in the LED chip to the outside when it is lit and discharging it to  
20 the atmosphere or the like. (For example, see Patent Document 1)

##### Patent Document 1

The Japanese Patent Laid-Open No. 2000-150968 (Paragraph 0011 through Paragraph 0034, Figure 1)

Nevertheless, when a light fixture using an LED lamp as a light source is  
25 employed as a vehicle lamp fixture for a headlamp or the like, strict light distribution characteristics are set forth in relevant standards and other

- regulations with regard to prevent the drivers of oncoming vehicles from being dazzled by the light directed forwards. Furthermore, the configuration of lamps for the headlamp or the like is established in consideration of incandescent light bulbs and other similar items emitting light flux uniformly in almost all directions.
- 5 Consequently, problems exist in that light distribution characteristics and the like cannot be satisfied by simply replacing the lamp with an LED lamp radiating light in a single inclined direction. in a relatively large amount

#### SUMMARY OF THE INVENTION

- 10 As a tangible means of resolving the problems known in the prior art, the present invention realizes an LED lamp for a light source of a headlamp characterized in that an LED chip or a white LED light emission portion comprising an LED lamp and fluorophor is disposed in the vicinity of the focus of a projection means, and a shielding member covering a portion of the white
- 15 LED light emission portion is provided in a formation allowing a light distribution characteristic suitable for a vehicle headlamp to be obtained when light from the white LED light emission portion is magnified and projected in an illumination direction by the projection means. Accordingly, the problems are resolved by enabling the regulated light distribution characteristics to be accurately and
- 20 easily achieved even when an LED lamp is used as a light source.

#### BRIEF DESCRIPTION OF THE DRAWINGS

- These and others and advantages of the present invention will become clear from following description with reference to the accompanying drawing,
- 25 wherein:

Fig. 1 is a perspective view showing an LED lamp for a light source of a

headlamp according to a preferred embodiment of the present invention.

Fig. 2 is a cross-section view on A-A of Fig. 1.

Fig. 3 is an explanatory drawing showing a typical passing light distribution characteristic obtained by the present invention.

5 Fig. 4 is an explanatory drawing showing an embodiment of the LED lamp for the light source of the headlamp according to the present invention when a projection lens is assembled thereto.

Fig. 5 is a cross-section view showing a typical configuration of a shielding member in the LED lamp for a light source of a headlamp according to  
10 the present invention.

Fig. 6 is an explanatory drawing showing typical chromatic aberration occurring in the projection lens.

Fig. 7 is a cross-section view showing another typical configuration of the shielding member in the LED lamp for the light source of the headlamp  
15 according to the present invention.

Fig. 8 is a cross-section view showing a further typical configuration of the shielding member in the LED lamp for the light source of the headlamp according to the present invention.

Fig. 9 is an explanatory drawing showing a typical configuration of the  
20 headlamp light when a plurality of LED lamps for the light source of the headlamp and projection lenses are combined.

Fig. 10 is an explanatory drawing showing a typical shaping method for a light distribution characteristic when a plurality of LED lamps for the light source of the headlamp and projection lenses are combined.

25 Fig. 11 is an explanatory drawing showing a configuration when the LED lamp for the light source of a headlamp according to the present invention is

combined with a reflector.

#### REFERENCES

- 1: LED lamp for a light source of a headlamp
- 2: LED chip
- 5 3: Base unit
- 3a: Base
- 3b: Lead frame
- 3c: Insulating layer
- 4: Metal wire
- 10 5: Fluorophor
- 6: Window glass member
- 7: Shielding member
- 7a: Serrated section
- 8: White LED light emission portion
- 15 9: ~~Silicon~~ <sup>Silicone</sup> gel
- 10: Projection lens
- 11: Reflector
- 12: ~~ITO film~~ <sup>SiO<sub>2</sub> film</sup>

#### 20 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Hereinafter, the present invention will be described by way of preferred embodiments thereof with reference to the accompanying drawings. The part indicated by reference 1 in Fig. 1 and Fig. 2 is an LED lamp for a light source of a headlamp according to the present invention (hereinafter referred to as an  
 25 "LED lamp 1"), and in the LED lamp 1, an LED chip 2 is mounted on a base unit 3.

The base unit 3 provides a base 3a formed with a metal member of copper or some other metal excellent in heat conduction and a lead frame 3b also formed with a metal member. The base 3a and the lead frame 3b are insulated by an insulating layer 3c formed with a resin member or another  
5 similar insulating member. The LED chip 2 mounted on the base 3a is wired to the lead frame 3b using a metal wire 4 or the equivalent, so the lighting can be carried out using power supplied from the exterior.

Considering the conditions to be satisfied for usage of the LED lamp 1 as a light source for a headlamp, it can be seen that the regulated color of the lamp  
10 is white or monochromatic yellow. Although white light is used more often, no LED chip 2 that can directly emit white light actually exists, and fluorophor 5 are used in combination in order to obtain white light.

As a first method of doing so, an LED chip 2 generating blue light and  
15 fluorophor 5 emitting yellow light are combined, and white light is obtained by mixing the blue light emitted directly from the LED chip 2 with the yellow light emitted from the fluorophor 5 excited by the light from the LED chip 2. As a second method, furthermore, the LED chip 2 emitting ultra-violet light is combined with fluorophor 5 emitting light of the three primaries red (R), green (G), and blue (B). In this case, the light emitted directly from the LED chip 2 is  
20 not used as illumination light, and the illumination light from the LED lamp 1 comprises the light emitted from the fluorophor 5.

The present invention will hereinafter be described in terms of a light source for a headlamp using a white LED light emission portion 8 combining an LED chip 2 and fluorophor 5; nevertheless, in situations where it is required that  
25 the lamp color be yellow, for example, it is possible for the light emitted directly from the LED chip 2 to be used as the light for the light source. In such a

*a wavelength  
conversion  
member  
such as*

situation, however, it is also possible for the present invention to be implemented, and it is sufficient for the white LED light emission portion 8 to be replaced by the LED chip 2 in this case.

Parts such as the LED chip 2, a metal wire 4, and fluorophor 5 are  
5 mechanically weak and do not ~~benefit from~~<sup>have</sup> good resistance to humidity and other similar factors. Accordingly, these parts are covered by a lens-shaped member formed from transparent resin or the like or by a ~~widow~~<sup>window</sup> glass member (the accompanying drawings show an example in which a ~~widow~~<sup>window</sup> glass member 6 is used), and through the action of this part and the base 3a, are sealed with  
10 respect to outside air. Thus, the above-described parts are prevented from breaking as a result of contact with the other parts, deteriorating as a result of humidity, and other similar factors. Furthermore, it is preferable to fill inert gas, ~~silicon~~<sup>silicone</sup> gel, or the like (this explanation assumes usage of ~~silicon~~<sup>silicone</sup> gel 9) into the space between the lens-shaped member or the ~~widow~~<sup>window</sup> glass member and the  
15 white LED light emission portion 8.

In addition, the LED lamp 2 according to the present invention provides a shielding member 7. Furthermore, this shielding member 7 covers a portion of the fluorophor 5, and for example, when light emitted from the fluorophor 5 is projected in the illumination direction by a projection lens or the like, allows a  
20 light distribution pattern for passing or any other desired light pattern to be obtained.

Accordingly, both the ~~widow~~<sup>window</sup> glass member 6 and the shielding member 7 are disposed more forward than the fluorophor in the illumination direction, and since the ~~widow~~<sup>window</sup> glass member 6 is transparent and the shielding member 7 is  
25 opaque, either of these parts can be disposed forward of the other. Furthermore, the shielding member 7 can be freely formed, for example, using the inner and

outer surfaces of the <sup>window</sup> ~~widow~~ glass member 6 with an opaque paint covering or vapor deposition of metallic member.

When a headlamp using the LED lamp 1 as a light source is used to provide light for an infrared night-vision device, a member transmitting the  
5 infrared light and shielding visible light is used for the <sup>window</sup> ~~widow~~ glass member 6, and in terms of the shielding member 7, it is sufficient to use a member shielding beam of light from infrared through visible light. Moreover, when the shielding member 7 is a vapor deposited film with the metallic member, deterioration as a result of oxidation and other similar factors are considered  
10 possible, and therefore, it is acceptable to provide protection by covering with a SiO<sub>2</sub> film as indicated by reference 12 in Fig. 2.

Reference HB from Fig. 3 indicates a typical passing light distribution pattern for left-hand drive situations. In this passing light distribution pattern HB, the half on the right of the vehicle centerline constitutes a light distribution  
15 pattern containing no upward directed light in order to prevent the drivers of oncoming vehicles from being dazzled. On the other hand, the half on the left of the vehicle centerline contains a section called an "elbow" in which upward directed light increases towards the left at an angle of 15° in order to allow traffic signs and the like on the road side to be easily identified.

20 In the present invention, the shape of the portion of the fluorophor 5 not covered by the shielding member 7 is made similar to that of the above-mentioned passing light distribution pattern HB. Moreover, as shown in Fig. 4, the shape of the fluorophor 5 obtained in this way is projected in the illumination direction P by a projection lens 10 to obtain the passing light distribution pattern  
25 HB. In order to ensure that highest intensity is in the front horizontal direction so that good long-distance visibility can be assured, when the LED chip 2 is

covered by the shielding member 7, this is performed at the point of highest intensity or at a position in the vicinity thereof.

Horizontal and vertical inversion occurs after projection by the projection lens 10, and therefore, the LED lamp 1 is mounted in the headlamp in a 180°-  
5 rotated condition, and when projection is carried out by the projection lens 10 in this condition, an erect image of the passing light distribution pattern HB can be obtained. Furthermore, by modifying the formation of the shielding member 7, light distribution patterns without an elbow, light distribution patterns for driving, and other types of light distribution pattern can be freely formed.

10 As a further description of the shielding member 7, it can be stated that since the shielding member 7 shields the light from the LED chip 2, when half thereof is covered, the quantity of light is halved, and in this way, loss occurs with respect to the quantity of light emitted from the LED chip 2. The results of studies by the inventors show that the treatment of the surface at least opposing  
15 the LED chip 2 has a minor effect on the <sup>shape of the</sup> light distribution characteristic formed after projection.

That is to say, when the surface of the shielding member 7 (i.e., the surface facing the projection lens 10) reflects light, this light is re-projected by the projection lens 10 and there is a high probability that formation of the light  
20 distribution pattern will be adversely affected. Therefore, it is preferable to provide non-reflection treatment of a color such as black. Nevertheless, a mirror finish is provided to the rear surface, and even when the light emitted from the LED chip 2 is reflected, this returns only to the LED chip 2 side and has no substantial effect on the formation of the boundary between the  
25 fluorophor 5 and the shielding member 7, or in other words, on the formation of the <sup>shape of the</sup> light distribution characteristic.

The light reflected by the rear surface of the shielding member 7 is returned to the inside of the fluorophor 5. Therefore, by providing, as shown in Fig. 5, a mirror finish on the rear surface of the shielding member 7 and, for example, a serrated section 7a emitting light to be reflected in the direction of the non-covered portion of the fluorophor 5, the brightness of light from the fluorophor 5 can be improved. In other words, the light reaching the rear surface of the shielding member 7 can be collected for use as illumination light, and it has been confirmed by trial manufacture and measurement by the

situation, however, it is also possible for the present invention to be implemented, and it is sufficient for the white LED light emission portion 8 to be replaced by the LED chip 2 in this case.

Parts such as the LED chip 2, a metal wire 4, and fluorophor 5 are  
5 mechanically weak and do not ~~benefit from~~<sup>have</sup> good resistance to humidity and other similar factors. Accordingly, these parts are covered by a lens-shaped member formed from transparent resin or the like or by a ~~widow~~<sup>window</sup> glass member (the accompanying drawings show an example in which a ~~widow~~<sup>window</sup> glass member 6 is used), and through the action of this part and the base 3a, are sealed with  
10 respect to outside air. Thus the above-described parts are prevented from